REMARKS

The above-identified patent application has been amended and Applicants respectfully request the Examiner to reconsider and again examine the claims as amended.

Claims 5-8, 12, 13, 26-29, 39, and 45-50 are pending in the application. All claims are rejected. Claims 12, 13, 39, 42, and 39-44 are amended herein. Claims 40, 41, 43, and 44 are cancelled without prejudice or disclaimer. Claims 1-4, 9-11, 14-25, and 30-38 were previously cancelled. Claims 49 -52 are new and are fully supported throughout the specification as filed.

The Rejections under 35 U.S.C. §103(a)

The Examiner rejects Claims 5-8, 12-13, 26-29, and 39-48 under 35 U.S.C. §103(a) as being unpatentable over Azuma et al. ("Visualization Tools for Free Flight Air-Traffic Management") in view of Hancock (US 5,179,377) and Nowell ("Graphical Encoding for Information Visualization: Using Color, Shape, and Size to Convey Nominal and Quantitative Data," Lucille Terry Nowell).

Claims 12 and 13 are the independent claims at issue, and each is addressed below. Newly added independent claim 51 also is addressed below. Applicants submit that claim 12, as amended, is patentably distinct over Azuma, Hancock, and Nowell, because none of these references, taken alone or in combination, provides the invention as recited in claim 12, as amended [emphasis added] :

A system for conveying aircraft altitude to a human observer, the system comprising:

a processor continuously receiving latitude, longitude, and altitude information relating to an aircraft, wherein the processor determines, based on the altitude information, a shape for an icon representing the aircraft, **wherein the shape is the sole indicator of the altitude of the aircraft**; and

a display in operable communication with the processor, the display providing a two-dimensional planar view and having a first axis representing latitude and a second axis representing longitude, wherein the processor directs the display to present the icon at a position on the display indicative of the latitude and longitude of the aircraft, **wherein the shape of the displayed icon is the sole indicator of the altitude of the aircraft**, and wherein the processor directs the display to change the shape of the icon in response to receiving a change in the altitude information .

As the Examiner is aware, and as found in MPEP §2142 - 2143, in order to establish a prima facie case of obviousness, (a) the prior art references when combined must teach or suggest all the claim limitations; (b) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings; and (c) there must be a reasonable expectation of success. These MPEP sections also state that the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination. Further, MPEP §2143 states that evidence showing unexpected results and/or that there was no reasonable expectation of success may support a conclusion of nonobviousness. Applicants respectfully submit that, as explained below, the Examiner has not met the burdens (a)-(c) listed above and the other requirements listed above in order to establish prima facie obviousness.

(a) The prior art references when combined must teach or suggest all the claim limitations

Applicants assert that the prior art references when combined do not teach or suggest all the claim limitations. The Examiner already admits that Azuma does not teach or suggest *changing the shape of the icon* in a manner indicative of the received altitude, as required by claim 12, as amended. The Examiner likewise already admits that Hancock fails to expressly

teach changing the shape of the aircraft per se, itself on the display. To compensate, the Examiner relies on both Hancock and Nowell as allegedly providing teaching and/or suggestion for changing the shape of the icon in a manner indicative of the received altitude, and the Examiner also asserts that Hancock and Nowell teach and/or suggest that redundancy in coding a particular attribute is beneficial.

Even though the Examiner admits that Hancock "fails to expressly teach changing the shape of the aircraft per se," the Examiner again asserts that Hancock's description of overlaying (or "tagging") different threat symbols onto aircraft symbols based on their altitude and/or distance to current position, where the symbol changes based on advisory warning, "*can be read to suggest changing the shape of the icon based on the altitude information*". Applicants again fail to see how this Hancock can be viewed as suggesting this, because, as was argued previously, overlaying a second symbol onto a first symbol does not necessarily change the shape of the first symbol.

Furthermore, in the examples and illustrations provided in Hancock, no aircraft symbols/icons are ever shown or described as being changed in shape when symbols are superimposed thereon. Rather, in Hancock, the symbols being overlaid are known TCAS threat symbols, such as diamonds and squares, and they are clearly described and illustrated as being approximately proportional to the size of the aircraft being displayed such that they "fit in" to the contours of the displayed aircraft icon shape (e.g., triangles on wing tips, diamonds on the body of the aircraft, etc.).

In addition, as explained in the previous response. Hancock never teaches or suggests that any of the overlaid symbols change the shape of the aircraft icon itself in response to any changes in any information, including altitude information, as required by claim 12, as amended. The Examiner appears to recognize that Hancock's teaching regarding the shape is lacking, as the Examiner later observes (in connection with the Nowell reference, discussed below) that

Nowell (allegedly) teaches "that it would be obvious to change the shape of the icon itself, not merely symbols on the edge of the icon."

Applicants fail to see, however, how Nowell can be read as teaching or suggesting claim 12's requirement of changing a shape of an icon in response to receiving a change in information, where the information is being received continuously, as required by claim 12, as amended. Nowell describes experimenting with various graphical code devices (colors, sizes, shapes, etc) to encode results arising from manual searches of a digital library of documents. The results include document attributes that include display of qualitative and quantitative information, such as information about the document found (e.g., publication year) and relevance to search criteria (see Nowell at Sections 3.1-3, p. 16-17). Nowell wants to see how changing the way results are encoded graphically affects how accurately and/or quickly users can conduct their searches and find desired results on a screen crowded with other information. Although Nowell does, in some places, discuss use of shape to encode some of the quantitative information such as relevance, nowhere could Applicants find Nowell referring to changing the shape in response to continually receiving a change in quantitative or nominal information.

(b) There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination.

The Examiner appears to find the motivation to combine the references in connection with an element/feature that is not even part of claim 12, as amended. Specifically, the Examiner alleges that :

(i) "The Hancock reference further teaches that it is advisable to have redundant coding (e.g., different color, size, and overlaid threat symbol) for an icon representing the aircraft;

(ii) "Nowell clearly teaches that redundancy in coding a particular attribute is beneficial . . . [Where the office action goes on to cite several examples in Nowell where redundant coding was found to be useful]", and

(iii) "As a result, based on the teachings of Nowell . . . it would have been optimal to utilize redundant coding (in the form of shape with color) to emphasize any given quantity in order to immediately convey it to users."

Applicants respectfully note that Claim 12, as amended, does not recite redundant encoding for altitude, as Nowell defines redundant coding. See Nowell section 2.1.2., in which Nowell defines redundant encoding as requiring that the information conveyed by a given encoding **can also be extracted from another code** – for example using both shape and color to encode the same information.

In claim 12, as amended, only a **single** "code" – shape – is used as the sole indicator of the altitude of the aircraft. Therefore, claim 12 never recites that any other "code" or display element or display feature is used to convey altitude or is capable of providing altitude information. Thus, claim 12 does not recite "redundant encoding" for altitude, but instead actually recites a type of non-redundant encoding (also defined in Nowell section 2.1.2 as being the only means of accessing the information thus encoded).

The shape of claim 12 is located at a position on the x-axis and y-axis on the display so as to also convey latitude and longitude, so conceivably the shape of claim 12 as it appears on the display can convey three different things – but this is still not redundant encoding of altitude. Note that Nowell does not define redundant encoding as using a single code or feature to convey multiple types of information.

Further, Applicants note that Nowell does not provide a general teaching that redundant coding is always or usually beneficial to the user. Nowell explains that use of redundant encoding may result in a benefits tradeoff between speed and accuracy. The Examiner has

pointed to several experiments in Nowell where certain redundant coding combinations produced better results than certain single-code types and certain other redundant coding combinations. However, Nowell **also** provides numerous examples showing that not all types of redundant encoding are beneficial to users, including cases where one type of encoding interferes with use of another type of encoding (see, p. 59, first paragraph of Nowell). Consider just a few examples of this teaching away from Nowell:

> (a) Page 54, 3rd paragraph – "**We expected to find significant performance benefit from redundant encoding, but that was not the case**. Any code involving color produced a mean time approximately equal to that for color alone"
>
> (b) Page 59, first paragraph "Thus, we see that use of size to convey document type interferes with perception of shape as document relevance, and, conversely, use of shape to encode document relevance interferes with perception of size as document type.".
>
> (c) Page 60, 4th paragraph – "We again found little significant benefit to redundant encoding . . .[referring to size plus shape]"
>
> (d) Page 61, 2nd paragraph – "Again we found little significant benefit to redundant encoding. . [again referring to size plus shape]."
>
> (e) Page 72, 2nd paragraph – "We note, for example, the finding that redundant codes conveying document type do not consistently yield faster performance (see Section 5.1.1) but they do yield significantly fewer errors (Section 5.5).

The above teachings of Nowell arguably teach away from at least some types/combinations of redundant coding, such as size plus shape, as recited in dependent claims 1-4, 26-29, 39, and 42, as amended herein.

(C) There must be a reasonable expectation of success. Evidence showing unexpected results and/or that there was no reasonable expectation of success may support a conclusion of nonobviousness

Finally, Applicants contend that, based on the prior art of record, the subject matter of claim 12, which relies on shape to encode quantitative information (i.e., altitude) and changing that shape when the quantitative information changes, is an unexpected result, because the prior art (i.e., the art of record) teaches away from a reasonable expectation of success or other benefits of using shape alone (or shape plus size, for dependent claims 1-4, 26-29, 39, and 42) to encode quantitative information. None of the references of record (especially Nowell) teach that shape by itself (or shape plus size) is generally advantageous to use as the sole way to encode information. As noted previously, Nowell states that size interferes with shape and vice versa. Furthermore, **in many places Nowell teaches that color, not shape, is the best way to convey quantitative information and appears to teach away from the use of shape *by itself* to convey quantitative information (e.g., information such as altitude). Nowell also teaches in at least 17 unique places that a code other than shape by itself is most beneficial and/or that shape by itself is amongst the least beneficial to use.** Consider these examples from Nowell:

(1) p. 10. 3rd paragraph "color may have 'psychological precedence over shape' . . ."

(2) p. 11, section 2.1.3, quoting study by Cavanaugh showing geometric shapes as slower than all but one of 6 other graphical coding devices

(3) p. 11-12, quoting study by Tan showing shapes slowest to process and "most demanding" code to process among set of 5 graphical devices

(4) p. 24, 4th paragraph, "Shape has been said to be inappropriate for encoding quantitative data because shape does not form a natural continuum"

(5) p. 53, Figure 5.1, showing mean time to complete a document ordering task, showing icon shape by itself (S_T) as having the *longest* mean time of the 7 design points (graphical codes) tested, where the other codes included, e.g., color by itself (C_T), color plus size, size by itself, etc.

(6) p. 54, middle of page, Ranking of Unidimensional codes (one code device used) conveying nominal data, based on time, showing shape as slower than both size and color, a ranking Nowell says that parallels that of another researcher Christ.

(7) p. 55, Figure 5.2, showing mean time to complete a task identifying document relevance (quantitative data), showing icon shape (S_R) by itself as ranking only 5th out of 7 design points.

(8). p. 56, quoting study by Mackinlay" stating that "shape is unsuitable for encoding quantitative data"

(9) p. 59, Figure 5.6, showing use of icon shape (S_T) by itself for nominal data as ranking only 6th out of 7 in ease of use

(10) p. 61, Figure 5.7, showing use of icon shape (S_R) by itself for quantitative data ranking only 5th out of 7 in ease of use

(11) p. 62, Figure 5.9, showing use of icon shape (S_T) by itself for nominal data as ranking only 6th out of 7 in likelihood of use

(12) p. 63, Figure 5.10, showing use of icon shape (S_R) by itself for quantitative data ranking only 5th out of 7 in likelihood of use

(13) p. 66, Figure 5.12, showing use of icon shape (S_T) by itself for nominal data as having the 2nd most number of errors out of 7 codes used

(14) p. 66, Figure 5.13, showing use of icon shape (S_R) by itself for quantitative data as having the 2nd most number of errors out of 7 codes used

(15) p. 72, bottom paragraph, "Mackinlay and Cleveland and McGill agreed completely in their rankings, which suggest size as the most effective encoding for quantitative data, followed by color. Neither ranking suggested shape as an appropriate encoding for quantitative data, so we show it ranked third by both."

(16) p. 73, 2nd paragraph, "All of our rankings agree with Christ that color is the most effective graphical device for conveying quantitative data . . . we consistently rank shape more effective than size, while Christ does the opposite . . . "

(17) p. 74, 1st paragraph " . . . if a graphical perception task is required pertinent [sic] (e.g., where users must extract precise quantitative data or make precise numerical comparisons between two graphical objects), we suggest Cleveland and McGill, along with Mackinlay, provide better guidance" *[that is, Nowell agrees with the findings at (15) above]*

Any one of the above examples arguably points someone of skill in the art away from using shape alone for a system such as an air traffic control system, but surely the cumulative effect of the above examples is that one of skill in the art would not have a reasonable

expectation of success using shape alone, so that a claim that uses shape alone (supported by a specification recommending shape alone) is producing an unexpected result.

In addition, it is certainly well known in the art of air traffic control that "getting the picture" of an aircraft's location and heading, in three dimensions, "is time consuming, complicated, and error-prone," (see cols. 1-2 of Johnston, J.; Horlitz, K.; Edmiston, R., "Improving Situation Awareness Displays for Air Traffic Controller," Proceedings of the Seventh International Symposium of Aviation Psychology, 1993, Columbus, OH, Pages 338-334; this reference was made of record in the instant case by the Examiner in a prior office action dated May 4, 2006). Given that air-traffic control is already time consuming and cognitively demanding, Applicants fail to see how one of skill in the art could have a reasonable expectation of success using shape alone, given that it shape alone is (according to the prior art) slower than many other possible graphical device (see numbers 2, 3, 5-7 above), more error prone than other graphical devices (see 13, 14 above), less easy to use (see number 9, 10 above) and less liked by the testers (see numbers 11, 12 above).

Thus, as shown above, the art of record does not teach or suggest each and every element of claim 12, as amended, and furthermore the art of record teaches sufficiently away from claim 12, as amended such that, prior to the instant invention, no one of skill in the art would have a reasonable expectation of success with attempting the teachings of claim 12, as amended. Therefore, the results of claim 12, using shape alone to convey aircraft altitude, are unexpected. Thus, for at least the above reasons discussed in connection with claim 12, Applicants maintain that claim 12 (and all claims dependent therefrom; namely claims 5-8 and 42, 45, 46 and 49) are patentably distinguishable over the art or record, taken alone or in combination.

Rejection of Claim 13

Applicants submit that claim 13, as amended, also is patentably distinct over Azuma, Hancock, and Nowell, because none of these references, taken alone or in combination, provides the invention as recited in claim 13, as amended:

> A method of conveying location of an object, the method comprising:
> receiving location information continuously regarding the object, the location information including a first coordinate *x*, a second coordinate *y*, and a third coordinate *z*, wherein the third coordinate z represents an altitude of the object;
> correlating the first and second coordinates (*x,y*) with a location of an icon on a display, the display providing a two-dimensional planar view and having a first axis representing the *x* coordinate and a second axis representing the *y* coordinate;
> correlating the third coordinate *z* with a shape of the icon, wherein the icon shape is exclusively indicative of the value of the third coordinate z; and
> displaying the icon on the display, wherein the shape of the displayed icon changes in response to received changes in the value of the third coordinate z, and wherein the displayed icon has a position on the display indicative of the first and second coordinates (*x,y*).

The limitations recited in the method of claim 13, as amended, are similar to those of the system of claim 12, as amended, and were rejected on the same grounds. Accordingly, Applicants hereby repeat their arguments made above in connection with responding to and arguing over the rejection of claim 12, as amended.

In particular, claim 13, as amended, requires *correlating the third coordinate z [which represents an altitude of an object] with a shape of the icon, wherein the icon shape is* ***exclusively*** *indicative of the value of the third coordinate z and displaying the icon on the display, wherein the shape of the displayed icon changes in response to continuously received changes in the value of the third coordinate z.* As Applicants have clearly explained above in connection with claim 12, the combination of references fails to teach or suggest all of these limitations, and the references themselves fail to provide any teaching or suggestion to make the combination that the Examiner suggests. As with claim 12, as amended, **use of shape exclusively to indicate altitude of an object is an unexpected result that runs counter the**

teachings of the references, which references predict little to no reasonable expectation of success with using shape alone for either quantitative or qualitative data.

Thus, for at least the above reasons (which are essentially the same as those discussed in connection with claim 12), Applicants maintain that claim 13 (and all claims dependent therefrom; namely claims 26-29, 39, 47, 48, and 50) is likewise patentably distinguishable over the art or record, taken alone or in combination.

In view of the above, Applicants submit that the rejection of Claims 5-8, 12-13, 26-29, 30, 42, 45, and 46-48 under 35 U.S.C. §103(a) should be removed.

Newly added claims

Newly added dependent claims 49 and 50 have support throughout the specification as filed and depend from independent claims 12 and 13, which are believed to be allowable. Thus, Applicants submit that Claims 49 and 50 are allowable over the cited references of record in this case at least for the reasons discussed above in conjunction with Claim 12. Applicants also believe that newly added claims 49 and 50 contain allowable subject matter and should not require additional searching and consideration. Consideration of new Claims 49 and 50 is respectfully requested.

Newly added independent claim 51 and dependent claim 52 are supported by the specification, as filed, and contain limitations and subject matter similar to that found in claims 5, 12, 13 and 26. Applicants believe that these claims contain allowable subject matter and should not require additional searching and consideration. Applicants submit that Claims 51 and 52 are allowable over the cited references of record in this case at least for the reasons discussed above in conjunction with Claim 12. Accordingly, Applicants respectfully request consideration of claim 51 and 52, as well.

The Examiner is respectfully invited to telephone the undersigning attorney if there are any questions regarding this Amendment and Response or this application.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 500845, including but not limited to, any charges for extensions of time under 37 C.F.R. §1.136.

Respectfully submitted,

Dated: 8/3/07

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